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Canadian Science Advisory Secretariat
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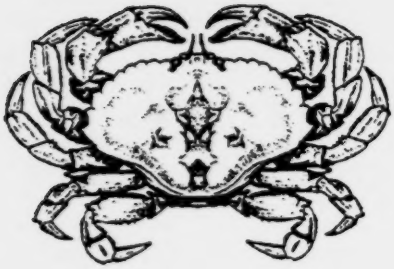
ROCK CRAB OF THE COASTAL WATERS OF QUEBEC IN 2009



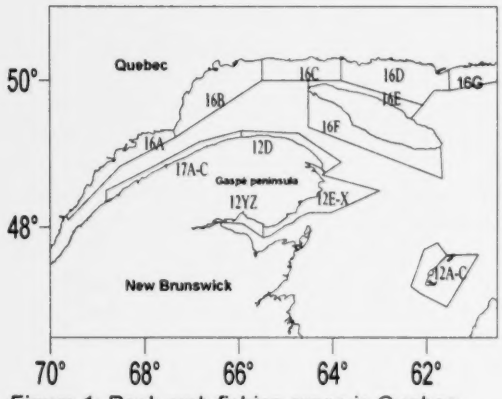


Figure 1: Rock crab fishing areas in Quebec.

Context

In Quebec, commercial fishing of rock crab began in 1988, but the fishery did not really begin to take off until 1995, first in the southern part of the Gaspé Peninsula (12E-Z) and Magdalen Islands (12A-C), then along the north shore of the Gaspé Peninsula (12D and 17) and, since 2004, on the North Shore and Anticosti Island (16B–E).

It is common knowledge that rock crab is an important prey species for lobster. This interaction between the two species justifies very cautious management of the rock crab fishery to prevent any impact on lobster. Thus, as soon as rock crab exploitation began, the fishery was managed by a conservation plan intended to protect the trophic relationships between these two species. The management measures currently in place are for protecting the reproductive potential by keeping exploitation rates low or moderate.

The fishery is managed by limiting fishing effort. The number of licences and trap sizes are limited, as is the fishing season. Furthermore, catches are limited by individual quotas in the Magdalen Islands, and up to 2008, by an overall quota in Areas 12Y and 12Z. A minimum legal carapace width has been set at 102 mm creating an exclusively male-directed fishery. Keeping a log-book is mandatory.

Stock assessment of rock crab is in response to a request from the DFO Fisheries and Aquaculture Management Branch. Assessments are conducted every three years and the last assessment was carried out after the 2006 fishing season (DFO 2007). This assessment covers the 2007-2009 fishing seasons and recommendations are provided for the 2010-2012 fishing seasons. It is based almost exclusively on indicators from the fishery.

March 2010

Canada

SUMMARY

- Landings of rock crab in Quebec totalled 1,813 t in 2009 and were almost exclusively from the directed fishery. Directed fishery landings have remained stable since 2006. In 2009, landings came in almost equal proportions from the southern part of the Gaspé Peninsula (36%) and Magdalen Islands (34%), the northern part of the Gaspé Peninsula and the North Shore accounting for 21% and 9% respectively.

- Catch rates have remained above or close to historical averages in the Gaspé Peninsula and North Shore since 2006. They declined in the Magdalen Islands and in 2009, they were about 20% below the 1998-2008 average. It is therefore recommended to lower quotas in the Magdalen Islands.

- In most regions, the size structures and average sizes have remained stable for several years. Decreases in average size and abundance of large crabs were observed locally, suggesting an overly high fishing pressure in some sectors.

- For all of Quebec, it is recommended not to increase the intensity of the directed fishery given the context of uncertainty associated with the possibility for lobster fishermen to conserve and land rock crab by-catches without them being controlled.

- In addition, the directed fishery effort currently deployed is significantly lower than the effort permitted by the existing management measures. The deployment of latent effort would increase the exploitation rate, with unknown consequences on the stability observed until now. To eliminate this latent effort, it is recommended to set the effort or catch level to that from years when the resource's productivity was sustained.

BACKGROUND

Species Biology

The rock crab *(Cancer irroratus)* is found along the east coast of North America, from Labrador to South Carolina. This species is associated with various bottom types, ranging from bedrock to soft bottoms. Commercial-size crabs and, more generally, those larger than 50 mm (size corresponds to carapace width) live on sandy or muddy bottoms, while a smaller portion of the adult population share rocky bottoms, where lobster also occur, with individuals smaller than 50 mm. Berried female rock crabs show a marked preference for soft bottoms, where they can bury themselves and where they form aggregations.

Males and females grow to different sizes. Males can reach 140 mm, while females rarely exceed 100 mm. Reproduction occurs in the fall after the females have moulted and while their carapaces are still soft. Males moult in winter so their carapace has fully hardened by spawning season. Carapace hardens completely in two to three months. Females reach sexual maturity at about 60 mm, while males do so at a slightly larger size (≈70 mm). Females lay their eggs, and then keep them under their abdomen for

nearly 10 months. A 60-mm female can lay 125,000 eggs, while a 90-mm female can lay up to 500,000. The eggs hatch the summer after they are laid, and the larvae which go through five pelagic stages remain in the water column from mid-June to mid-September. In the fall, the larvae metamorphose into tiny crabs (megalops) and begin their benthic life shortly thereafter. Juveniles (<15 mm) are found mainly at shallow depths on bottoms that offer shelter from predators and water turbulence. Growth data for rock crab in the Gulf of St. Lawrence are rather sparse. Data from regions further south suggest that rock crab may attain commercial size at about five or six years of age and live to about seven years.

The rock crab is omnivorous and displays a certain amount of opportunism in its diet. Lobster has never been shown to constitute a significant portion of the rock crab's diet, but analyses of lobster stomach contents indicate that rock crab is a major prey for lobster throughout the lobster's life cycle, even from the earliest larval stage.

The Fishery

Rock crab is managed by a directed fishery for which a licence is required. In 2009, there were 63 directed fishing licences in Quebec. Rock crab is also caught by a varying number of lobster fishermen (over 600 in Quebec) who are entitled to keep rock crab by-catches. Catches that are sold are recorded, but there is no accurate data on the quantity of rock crab that is used as bait in the lobster fishery.

The rock crab fishery is managed by controlling fishing effort among other things. The number of licences and traps is limited, as is the size of the traps and fishing season. Catches are controlled in the Magdalen Islands (individual quotas) and preventive quotas were set in the Gaspé Peninsula in Areas 12YZ until 2008. A minimum legal carapace width of 102 mm is in effect and females are excluded from the fishery.

The fishery is also managed by fishing areas (Figures 1, 2 and 3), so that fishing effort can be distributed more evenly. In the Gaspé Peninsula, the fishing effort was distributed based on the same fishing sub-areas as for the lobster fishery. In the southern part of the Gaspé Peninsula (12E to 12Z), rock crab directed fishing licence holders also have lobster fishing licences. Exclusion areas were established in the northern Gaspé Peninsula in 2009 (Figure 3) to protect a portion of the rock crab population and monitor its natural evolution. In addition, in the southern Gaspé Peninsula, there are several sub-areas that are purposely not exploited because fishermen are concerned that the rock crab fishery may harm lobster. There is also an exclusion area in the Magdalen Islands (12C1) which was closed to the rock crab directed fishery in 2000 (Figure 2).

The fishing season has been limited to 10 weeks in the Gaspé Peninsula since 2009, but it lasts 20-24 weeks on the North Shore. Fishing licences have been permanent in the Magdalen Islands since 2003, and since 2009 in the Gaspé Peninsula. They remain exploratory on the North Shore and Anticosti.

In 2009, in the Magdalen Islands, 14 fishermen had a rock crab directed fishing licence with an individual quota of 45.5 t. An overall quota of 681 t was established for the Magdalen Islands, which includes a quota of 45.5 t to account for rock crab by-catches by lobster vessels. There are two types of traps in the Magdalen Islands and every fisherman can use 85 small (1.219 m [4 feet] in diameter) or 140 large (0.914 m [3 feet]

in diameter) traps, or any combination of these two types of traps calculated according to an equivalency factor of 1 large trap for 1.66 small traps, based on their relative effectiveness. Fishermen have access to one, or in some cases, two of the three areas. In the Gaspé Peninsula in 2009 in the northern areas (Areas 17 and 12D1-D7) and southern areas (Areas 12EZ) (Figure 3), there were respectively 9 and 23 active fishermen. The number of traps per fisherman varies from 75 to 150 depending on the area. On the North Shore and north of Anticosti (16BE), 17 licences were issued in 2009 and each fisherman could use 150 traps. Two fishermen from 16B are allowed to operate in 12 E with 200 traps.

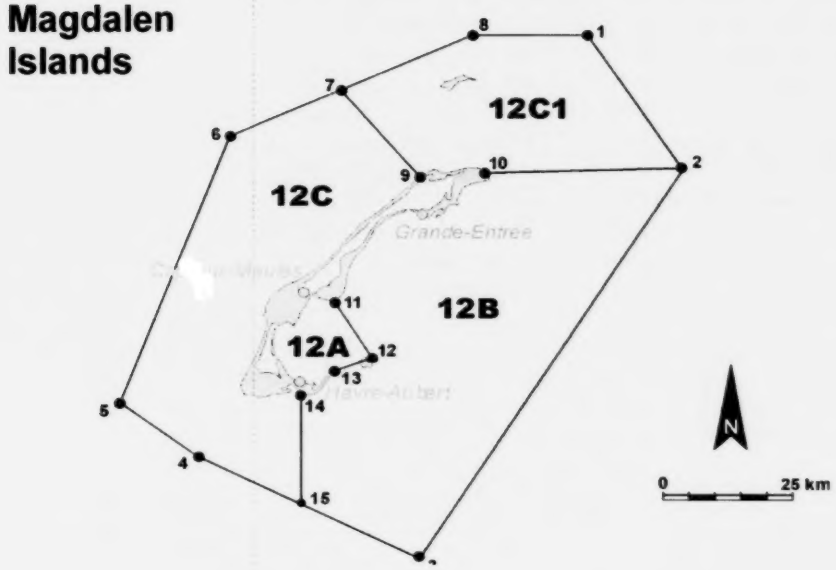


Figure 2. Rock crab fishery sub-areas at the Magdalen Islands (12 A, 12B and 12C) and the exclusion Area (12C1).

ASSESSMENT

Source of Information

The resource assessment is based primarily on the review of abundance indicators and the size of crabs landed. The abundance indicators are the landings and catch rates or catch per unit effort (CPUE) during the directed fishery. Landings and CPUE are built from logbooks that became mandatory in 1995 in the Magdalen Islands, in the Gaspé Peninsula in 2001 and on the North Shore in 2004. The landing data recorded in logbooks are validated by purchase slips and dockside weighing. The data on average sizes and size structures stem from dockside sampling. Over 10,000 crabs are measured annually in a dozen sub-areas. A trawl survey has been conducted in the

southern part of the Magdalen Islands since 1995 in order to obtain abundance and demographic indicators for lobster. Rock crab by-catches are also analyzed to obtain abundance and recruitment indicators. A trap survey took place in 2008 in the northern Gaspé Peninsula to characterize rock crab populations in two exclusion areas (AP5-6) and adjacent fishing areas (12D4-6) (Figure 3).

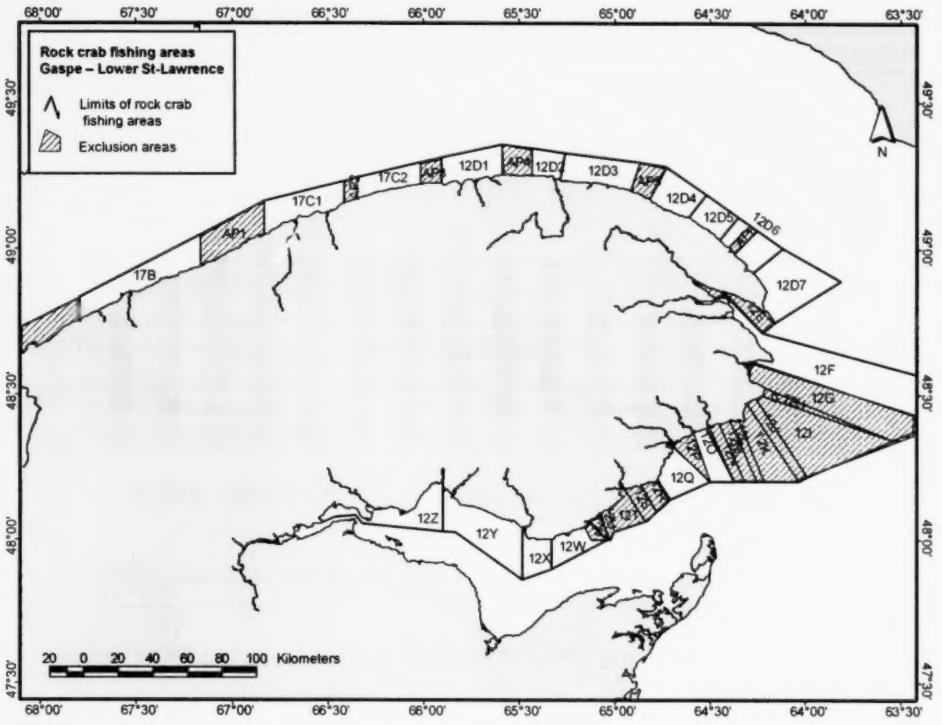


Figure 3. Rock crab fishery sub-areas in the Gaspé Peninsula. Sub-areas that are not exploited and the six exclusion areas (AP1-6) established in the northern Gaspé Peninsula are marked in red.

Landings

Rock crab landings for all of Quebec totalled 1,813 t in 2009 and came almost exclusively from the directed fishery (Figure 4, Table 1). In 2009, by-catches represented only 8 t. Total landings were higher between 2005 and 2007, exceeding 1,900 tons, due to the significance of by-catches by lobster vessels during those three years. Between 2005 and 2007, catches totalled between 143 and 181 t, representing 8-9% of total landings in Quebec. Landings from the directed fishery totalled 1,805 t in 2009, which is slightly higher than what was recorded during the 2006-2008 period while landings fluctuated between 1,742 and 1,772 t. In 2009, landings came in almost equal proportions from the southern Gaspé Peninsula (36%) and the Magdalen Islands (34%), the northern Gaspe Peninsula and the North Shore accounting for 21% and 9% of the landings respectively.

The rock crab fishery really took off in Quebec in 1995 with 829 tons landed. Landings gradually increased from 688 t in 1996 to 1,803 t in 2002. Since 2002, they have been above 1,700 t (Figure 4).

Landings from the directed fishery in the Magdalen Islands totalled 620 t in 2009 (Table1). The quota for the directed fishery (636 t) has usually been reached since 2002. In 2008 and 2009, there were no rock crab landings during the lobster fishery. However, between 2005 and 2007, by-catches were significant, between 131 t and 169 t, which exceeded the overall quota (681 t), by 13-18%.

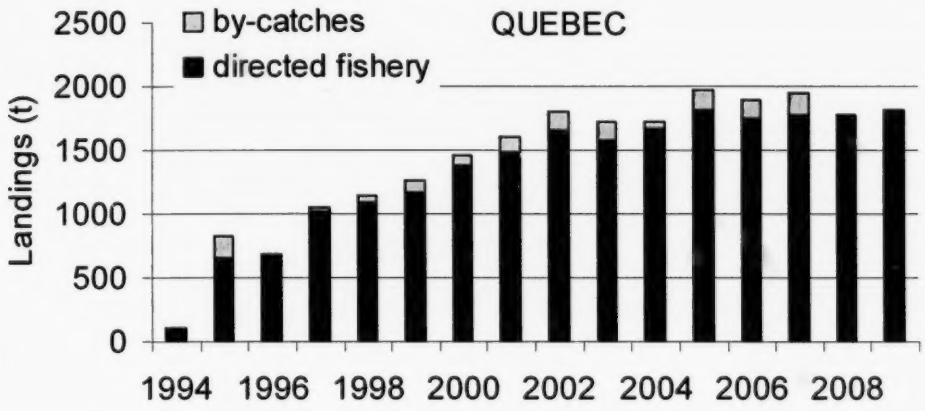


Figure 4. Total rock crab landings (t) in Quebec from 1994 to 2009. Values for 2009 are preliminary.

Landings from the directed fishing in the Gaspé Peninsula totalled 1,020 t in 2009, which was higher than in 2006 (928 t). There have been very few by-catches landed in the Gaspé Peninsula since 2006, and in 2009 they represented less than 1% of total landings. On the south side of the Gaspé Peninsula, landings from the directed fishery totalled 640 t in 2009, which was about 15% higher than 2006-2008 landings (Table 1). In 12Y and 12Z, landings in 2009 were much higher than in 2006 (30 and 60%), whereas they were lower by 5 and 11% in 12EP and 12QX (Table 1). On the north side of the Gaspé Peninsula, landings from the directed fishery totalled 380 t in 2009 (Table 1). They were equivalent to what was observed in 2006 (374 t). Landings were highest in 2008 with 432 t. Landings in the northern Gaspé Peninsula were almost exclusively from 12D. Generally, the fishing effort (number of trap hauls) in 2009 in the southern Gaspé Peninsula was slightly lower than 2006, except for 12Z where it increased by almost 30%. In the northern Gaspé Peninsula, the effort has increased by about 15% between 2006 and 2009.

On the North Shore, fishing began to develop in 2004. Landings in 2009 totalled 165 t, which was slightly less than in 2006 (180 t). Landings had reached 231 t in 2007. Fishing is mostly conducted in 16B and 16D. In 16B, the fishery was concentrated in three bays, Sept-Îles, Port-Cartier and des Homards. In 2009, 70% of the landings came from 16B, 27% from 16D and 3% from 16C. There was no fishing in 16E in 2009 unlike the previous four years. No rock crab by-catches by lobster vessels have been reported since 2005. The fishing effort in 2009 was about 15% lower than in 2006.

Catch Rates

Catch rates have been down in the Magdalen Islands since 2004 and the decline has been sharper and more rapid for 4' traps than for 3' traps. Catch rates (CPUE standardized to reflect the two types of traps) were lower by between 16-26% in 2009 compared to 2006 according to the area (Table 2). They totalled between 16.1 and 23.8 kg/trap in 2009, compared to 21.7-29.6 kg/trap in 2006. For the three areas, catch rates in 2009 were lower than their respective averages for the 1998-2008 period. The difference was significant for 12B and 12C.

Table 1. Rock crab landings (t) in Quebec from 2000 to 2009 and per area and sub-area (directed fishery). 2009 values are oreliminary. Total by-catches are indicated.

Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
12A	57	133	117	112	115	113	124	114	130	125
12B	340	257	291	296	292	301	284	299	279	285
12C	181	224	213	266	228	223	226	220	227	210
Magdalen Islands	**578**	**614**	**621**	**674**	**634**	**636**	**635**	**634**	**636**	**620**
17	15	19	40	29	17	11	10	5	10	8
12D	167	218	327	263	268	394	365	395	423	372
Gaspé North	**182**	**237**	**366**	**291**	**285**	**405**	**374**	**399**	**432**	**380**
12EP	172	161	161	172	154	164	149	121	141	141
12QX	170	189	192	145	152	150	158	155	136	140
12Y	145	130	149	112	119	110	112	139	116	145
12Z	152	166	175	211	186	115	135	151	151	214
Gaspé South	**638**	**645**	**676**	**640**	**610**	**539**	**554**	**566**	**543**	**640**
Gaspé Total	**820**	**882**	**1043**	**931**	**895**	**944**	**928**	**965**	**976**	**1020**
16A	0	0	0	0	0	0	0	0	0	0
16B	3	15	1	1	83	125	79	88	75	116
16C	0	0	0	0	3	6	4	1	0	5
16D	0	0	0	14	53	46	40	41	39	44
16E	0	2	0	0	0	54	57	43	35	0
16G	0	3	0	1	2	0	0	0	0	0
North Shore	**3**	**21**	**1**	**16**	**141**	**231**	**180**	**173**	**148**	**165**
Others	10	9		32	19	1				
Total dir. Quebec	**1412**	**1526**	**1665**	**1653**	**1689**	**1812**	**1742**	**1772**	**1760**	**1805**
By-catches	73	113	138	139	49	158	143	181	18	8
TOTAL Quebec	**1484**	**1639**	**1803**	**1792**	**1738**	**1970**	**1886**	**1952**	**1778**	**1813**

Catch rates have been stable since 2006 in two of the four areas in the southern Gaspé Peninsula (12EP and 12QX) and have increased by 12% and 23% in 12Y and 12Z, respectively (Table 2). In 2009, catch rates from the four areas were above average for the 2001-2008 period. Since 2001, the average catch rates have been around 5-7 kg/trap in 12EP, 12 QX, 12Y and around 13 kg/trap in 12Z. On the northern side of the Gaspé Peninsula, catch rates were down 7% in 2009 in 12D4-D7 compared to 2006, but did not differ from the 2001-2008 average (13 kg/trap). In 17-12D3, catch rates

increased in 2009 compared to 2006. They reached 7.6 kg/trap, which is 33% higher than the 2001-2008 average. In the northern Gaspé Peninsula, yields were about twice as low in the west (17 up to 12D3) than in the east (12D4 to 12D7).

The average catch rates calculated for the entire North Shore and Anticosti (16BE) have been fairly stable since 2004, ranging between 6 and 7 kg/trap (Table 2). Catch rates in 2009 were the highest in the series. Significant differences exist between sub-areas on the North Shore. Catch rates of 6-7 kg/trap are reached in 16B and 16D while in 16C, average catch rates are twice as low, at around 3 kg/trap. Higher catch rates were made at Anticosti Island (16E) with an average of 10 kg/trap for the 2005-2008 period.

Table 2. Estimated rock crab catch rates (kg/trap) based on logbook data. Catch rates from 12A-C were standardized to account for both types of traps. Averages are calculated for periods when reliable log-book data were available. The value of 2009 is excluded from the average.

Area	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Means
Magdalen Islands													
12A	16.1	18.4	24.3	26.6	26.7	26.9	32.3	30.7	29.6	26.6	22.0	23.8	**25.5**
12B	17.4	21.8	21.7	21.6	22.3	27.4	29.9	25.1	22.4	22.1	19.9	18.8	**22.9**
12C	13.1	15.1	16.6	18.6	22.7	31.5	25.1	25.1	21.7	17.4	20.5	16.1	**20.7**
Gaspé North													
17, 12D1-D3				3.5	4.7	5.0	5.8	6.3	6.7	6.6	6.7	7.6	**5.7**
12D4-D7				8.4	11.0	10.4	12.4	14.6	14.0	14.3	14.9	13.0	**13.1**
Gaspé South													
12EP				4.8	5.3	6.1	6.2	6.4	6.1	5.4	6.2	6.0	**5.8**
12QX				4.8	4.2	5.0	5.2	5.7	6.1	6.4	5.9	6.1	**5.4**
12Y				7.4	7.5	7.3	8.0	7.9	6.5	7.0	7.6	7.3	**7.4**
12Z				13.7	11.9	13.0	11.4	14.6	12.6	14.7	13.5	15.6	**13.2**
North Shore													
16B-E							6.1	6.7	6.5	6.2	6.7	7.1	**6.5**

Size Structures

The size structures have varied little in the Magdalen Islands since 1997. In 2009, the sizes were high at 125 mm in 12A and 12B and at 122 mm in 12C (Figure 5). This is higher than the 1995-2008 averages, which were 123 mm in 12A, 124 mm in 12B and 120 mm in 12C. This increase in average size, combined to the decrease in catch rates described above, could be associated with reduced recruitment. Despite this increase, however, we observed a decrease in large crabs (>130 mm) between 2006 and 2009 in 12 C (Figure 5). This reduction could be the consequence of excessive fishing pressure.

The size structures of crabs landed in 2009 in the four areas of the southern Gaspé Peninsula (Figure 6) were not very different from 2006. In 2009, the average sizes were between 110 and 113 mm depending on the area, which was slightly below the 1995-2008 average (1 mm). However, in 12Y, there has been a downward trend of 2-4 mm in size since 2005. On the north side of the Gaspé Peninsula, in 12D4-D7, size has also decreased by 3 mm since 2004 and in 2009, the average size was 116 mm (Figure 6). The decreases in size 12Y and 12D4-D7 could reflect an effect of fishing. The average size of crabs in 17-12D3 has been stable since 2006 at 121 mm.

On the North Shore, specifically in Area 16B, the size structures and average sizes changed between 2006 and 2009 (Figure 7). The average size has decreased by more than 3 mm within 3 years and the abundance of large crabs (>120 mm) has decreased. These elements, combined with an increase in CPUE suggest both the arrival of recruitment, but also an effect of fishing. In 16CD, average sizes have remained stable since 2004, around 115 mm. In 16E, average sizes ranged between 113 and 116 mm between 2004 and 2008.

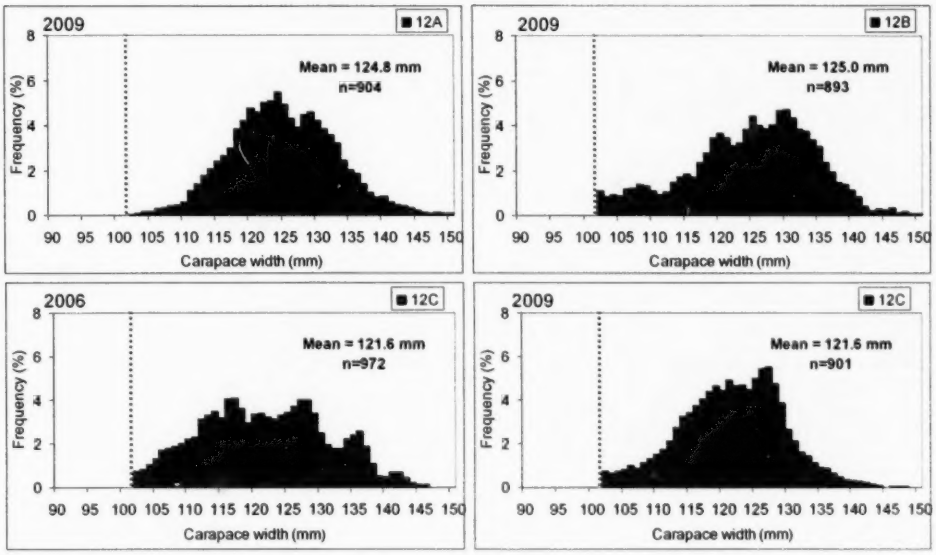


Figure 5. Size structures of rock crab landed in the Magdalen Islands in 2009 in 12A, 12B and in 2006 and 2009 in 12C. The numbers correspond to the number of crabs measured during dockside sampling. The dotted vertical line indicates minimum legal size.

Recruitment

The abundance indices of sublegal rock crabs obtained from the trawl survey suggest that there was a decline in rock crab recruitment between 2002 and 2007 in areas 12A-12B of the Magdalen Islands. The indices appear to have been increasing since 2007.

Sources of Uncertainty

Rock crab landings presented here do not take into account the by-catches made by lobster fishermen who use them as bait. In certain areas, this practice is quite common and could represent significant quantities. This practice could escalate in the future should the cost of traditional bait increase.

We don't really know the harvesting strategies used by the fishermen. In some cases, they might move around in their area in order to maintain good catch rates (hyperstability), which could, if any, conceal a drop in stock abundance. We do not know the impact on catch rates of the limitation imposed sometimes by plants on daily landings. In such cases, catch rates could voluntarily be maintained at a lower level.

Over the past three years, fishermen have improved the quality of data recorded in their logbooks, especially with regards to fishing positions. This data should help in the future to better identify the spatial harvesting pattern and better interpret catch rates trends.

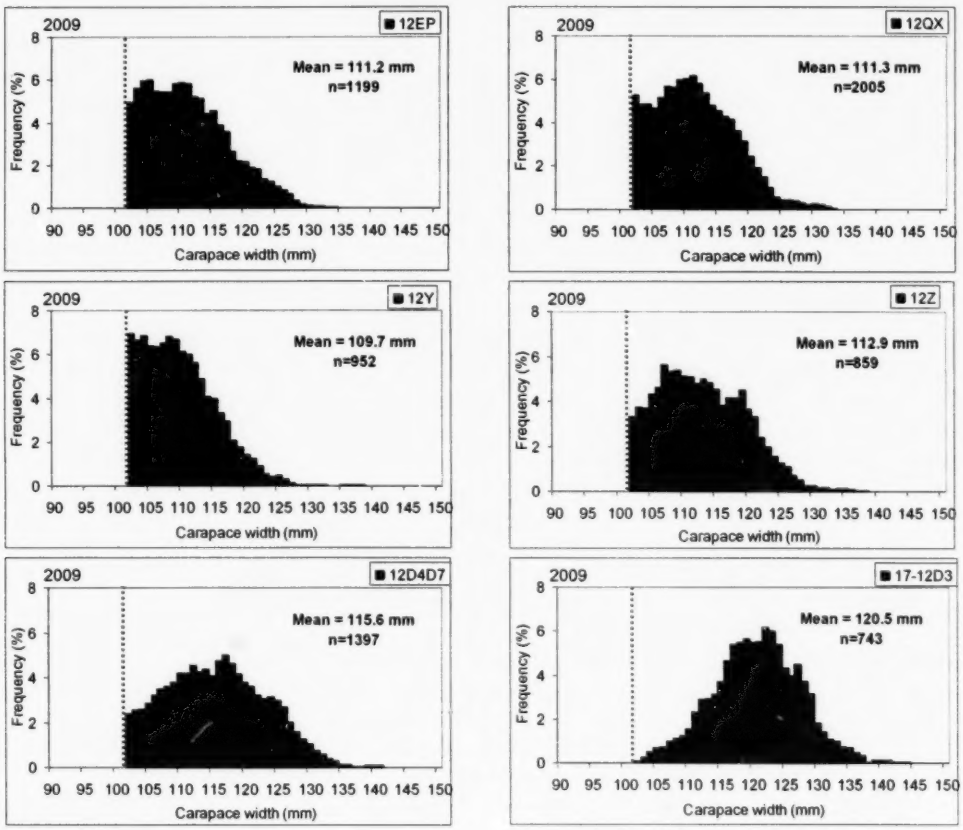


Figure 6. Size structures of rock crab landed in 2009 in the southern (12EP, 12QX, 12Y and 12Z) and northern (12D4-D7 and 17-12D3) Gaspé Peninsula areas. The numbers correspond to the number of crabs measured during dockside sampling. The dotted line indicates minimum legal size.

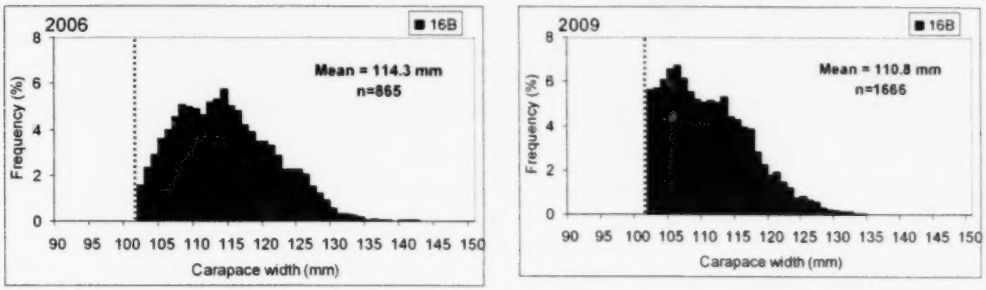


Figure 7. Size structures of rock crab landed in 2006 and 2009 on the North Shore (16B). The numbers correspond to the number of crabs measured during dockside sampling. The dotted line indicates minimum legal size.

Our knowledge on the dynamics of rock crab stocks is weak. We don't know if recruitment dynamics are cyclical as is the case with other crab species, and whether they are bottom-up (e.g. hydrodynamics) or top-down (e.g. predation) regulated. Our knowledge of growth and mortality is rather sparse which limits our interpretation of size structures in terms of the effects of fishing on populations. There are uncertainties regarding the data from the trawl used for the lobster survey. It is difficult to interpret changes in the abundance indicators and effectively distinguish between variations that are due to population changes and those due to changes in catchability.

CONCLUSIONS AND ADVICE

The development of the rock crab fishery in the Gaspé Peninsula and Magdalen Islands in the past fifteen years has been done in a cautious manner. In 2009, stock status indicators suggest that up to now, harvesting levels are not causing any major problems for populations. This complies with the management objectives established for this species and that attempt to maintain moderate harvesting levels. However, the management objectives of maintaining moderate harvesting levels are threatened by a lack of control of the by-catches by lobster vessels. In such a context of uncertainty and where latent effort is important, it is impossible to consider recommending an increase in the intensity of the directed fishery.

Even though the catch rates in the Magdalen Islands have been relatively high compared to other regions in Quebec, we have nevertheless observed a decrease since 2004. This decline may reflect a decline in recruitment, as there was a parallel increase in average size. The decrease in catch rates could also be a consequence of high by-catches between 2005 and 2007 that have resulted in an increase of the overall quota of around 15%. Recruitment indices from the trawl survey in 12AB seem positive for the coming years. However, until recruitment is obvious, and in order not to accentuate the decline in CPUE, it is recommended to reduce the quotas in a proportion equal to the difference between the average catch rate of 2007-2009 and the average from 1998-2006, which corresponds to a reduction of 12 % for the whole area. It is also recommended not to exceed the total quota established for this fishery so that in the event by-catches return to levels similar to those of 2005-2007, it would be imperative to limit the directed fishery accordingly.

Overall for the Gaspé Peninsula, fishery indicators have remained stable during the 2001-2009 period, suggesting that harvesting has had only a minor impact on populations. However, the decreases in size observed in 12Y and 12D4-D7 are of some concern, which may require a reduced level of fishing in these areas, should these decreases intensify in the future.

We note that the directed fishing effort currently deployed is substantially lower than the effort authorized by the existing management measures. Depending on the areas, the effort actually deployed does not exceed 28-63% of the effort permitted. The deployment of latent effort would increase the harvesting rate, with unknown consequences on the stability observed until now. To eliminate this latent effort, it is recommended to limit the level of effort, or catches, to levels when the productivity of the resource was sustained. The management proposal for the Gaspé Peninsula area of establishing a ceiling on catches based on historical catches by area from 2003 to 2007 in the southern Gaspé Peninsula, and on the 2001-2009 average for the northern Gaspé Peninsula (12D4 to 12D7) is consistent with this recommendation. For the northern Gaspé Peninsula further upstream (17-12D3) where fishing is still developing, it is recommended to set a ceiling equivalent to the 2009 catches, or 150 t. The introduction of a catch limit rather than simply limiting effort should be better for monitoring lobster vessel by-catches.

The rock crab fishery on the North Shore and Anticosti is still too recent to decide on its future. It is therefore premature to recommend permanent licences. Furthermore, although the fishing effort is limited, the actual effort deployed locally is less than 10% of the authorized effort. It is recommended to monitor the deployment of latent effort closely. It was noted, for example, that the fishing effort in 16B was concentrated in three bays. It is recommended not to increase fishing pressure in these three bays. A ceiling equal to the average effort or catches from 2004-2009 should be set for these three bays and all the additional effort should be deployed elsewhere in 16B.

OTHER CONSIDERATIONS

Rock crab is a major foraging species for lobster. It is therefore important that the harvesting of rock crab does not disrupt the trophic link between these two species. The management of this fishery has so far been conducted accordingly. The protection of reproductive potential by maintaining a minimum catch size beyond the size at sexual maturity and the control measures put in place to maintain moderate harvesting rates are expected to avoid disrupting the existing trophic links between the two species. The high minimum size also mitigates the impacts of fishing on the lobster diet since the latter does not prey on legal size crabs (> 102 mm).

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